UPDATE:
Virginia Board for Geology

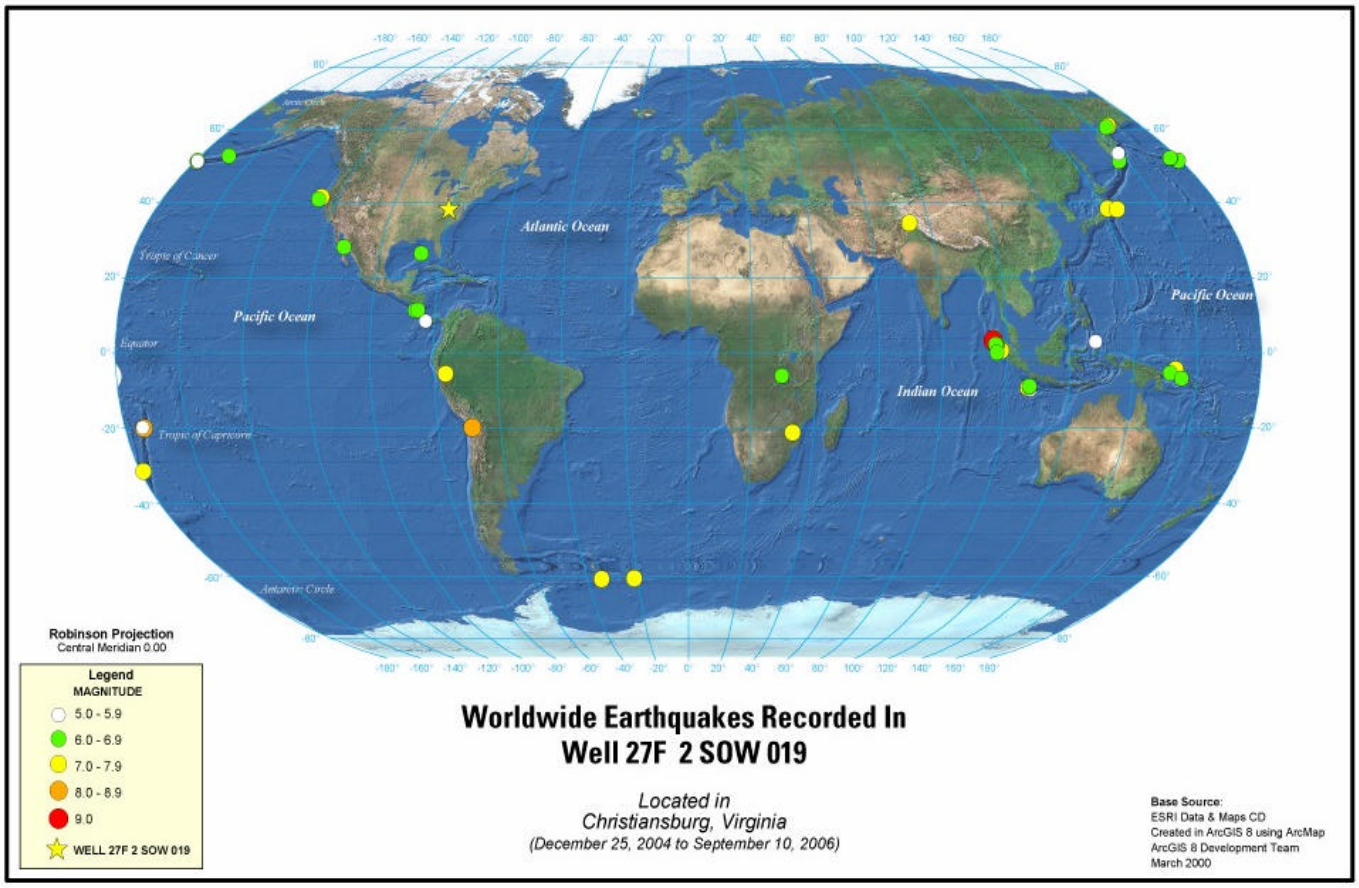
Fall - 2006

Sensitivity of Christiansburg Well to Earthquakes around the World

By David L. Nelms, *U.S. Geological Survey* and Eugene D. Powell, *Virginia Department of Environmental Quality*

Virginia observation well 27F 2 SOW 019, located in Christiansburg, is sensitive to teleseismic waves generated by large earthquakes (usually greater than magnitude 6.0) that occur around the world. This well is 450 feet deep and finished open hole to the carbonate rocks of the Elbrook Formation. Water enters the well through fractures or cracks in the rock. Compression and expansion of these fractures by seismic waves cause the water to be drawn in and out of the well, similar to the way bellows work. As ground water moves in and out of the well, the water level in the well rapidly rises and falls. This water-level oscillation is recorded at 5-minute intervals by a pressure transducer and data logger maintained by the Virginia Department of Environmental Quality. Every hour, these data are transmitted by satellite to a computer located at the U.S. Geological Survey Virginia Water Science Center (USGS VWSC) in Richmond and then presented on the real-time website at http://va.water.usgs.gov.

The sensitivity of this well to teleseismic waves has been recorded by a continuous-strip chart recorder since 1969. Real-time monitoring began in April 2004, and the recorded effects of the magnitude 9.0 Sumatra-Andaman Islands earthquake on December 25, 2004, at 7:58:52 PM (EST) brought worldwide attention to this well. The water level oscillated nearly 3 feet for about 7 hours after the earthquake. Since this earthquake, hydrologic responses to over 50 earthquakes have been observed and documented (fig. 1). These earthquakes range in magnitude from 5.3 to 7.9 and have caused the water level to oscillate from 0.02 to 1.01 feet. The earthquakes occurred in Central America, western North America, Africa, Japan, Russia, Pakistan, and numerous locations in Indonesia. An inventory of the earthquakes and respective hydrographs can be obtained at http://va.water.usgs.gov/earthquakes/index.htm. (Continued on Page two)



Christiansburg Well (From Page One):

Several activities related to this well are planned in the near future. A secondary monitoring system that will be triggered by earthquakes will be installed in the fall of 2006 and will record at 1-second intervals the subsequent and complete hydrologic response, which is referred to as a hydro seismogram. These data will be transmitted by cellular connection to a computer located at the USGS VWSC. In addition to the installation of the secondary monitoring system, a suite of sophisticated borehole geophysical logs (optical and acoustic televiewer, borehole radar, electromagnetic flow meter) will be collected in the winter of 2007 to determine the orientation, flow, and hydraulic properties of the fractures. Analysis of the hydro seismogram will indicate the individual hydrologic responses caused by the interaction of the various branches of the seismic wave train with the fractures identified in the borehole. A summary of activities related to the Christiansburg well will be presented on December 27, 2006, at the Science Museum of Virginia's Lunch Break Science series.

REGULATIONS AMENDMENTS EFFECTIVE AUGUST 1, 2006: Amendments to the Board for Geology Regulations went into effect on August 1, 2006 and a postcard notification was mailed to all Virginia Certified Geologists by the Board. The amended text may be found on the Board's Website: http://www.dpor.virginia.gov/dporweb/geo_main.cfm.

BOARD MEMBERS:

Joseph B. Vance (certified geologist)

Robin E. Reed (certified geologist)

J. Meade R. Anderson, Chair (certified geologist)

Katherine Shewey White (citizen member)

William S. Hastings (citizen member)

Edward E. Erb, Virginia State Geologist (*ex officio* member)

CONTACT THE BOARD: For your convenience, you can contact the Board for Geology with any questions or comments through several methods.

1. Phone: 804-367-8507
2. FAX: 804-367-6128
3. E-mail: geology@dpor.virginia.gov
4. Mail: Board for Geology, 3600 West Broad Street, Richmond, VA 23230

2007 Meetings of the Board for Geology

January 3, April 25, July 11, October 17

Meeting location:
Department of Professional and Occupational Regulation
3600 West Broad Street
Richmond, Virginia 23230

STAFF MEMBERS

Jay W. DeBoer ..... Director
David Ashe ..... Chief Deputy Director
Karen W. O'Neal..... Deputy Director, Licensing and Regulation
David Dick ..... Executive Director
Adrienne Mayo ..... Office Manager
Marilyn M. Cohn..... Administrative Assistant

New Board Member Appointed: Joseph B. Vance of Mechanicsville, Virginia has been appointed to the Board for Geology effective September 1, 2006. Mr. Vance has been with Marshall Miller & Associates since 1989, beginning as their Senior Project Geologist and Environmental Geologist in Bluefield, West Virginia. In 1993, Mr. Vance established MM&A's branch office in Ashland, Virginia and in 2001 became Senior Vice President/Senior Scientist. This year, he was promoted to Manager for the Environmental Division of MM&A. Mr. Vance is a Certified Geologist with the American Institute of Professional Geologists and the States of Tennessee and Virginia.

Returning from Active Duty Military Service? If your Virginia Certified Geologist certificate expired during your service outside of the United States, you have 60 days from the date of your release from Active Duty to renew your certificate without penalty. To qualify, please send a copy of your DD-214 or other appropriate documentation to verify your active duty status to the Board for Geology at DPOR.

REMINDER: Change of Address - **It is a Virginia certified professional geologist's responsibility to inform the Board of a change of address. Not receiving the renewal notice does not remove the responsibility of renewal from the regulant.**